structural bioinformatic assignment03

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1 Theoretical exercises

1.1 Task 1

We picked the protein 'vimentin' (pdb code: 1GK7) because of its various functions in the human body.
Vimentin is an intermediate filament and therefore part of the cells cytoskeleton. Despite the known tasks of the cell skeleton as migration, cell stabilization, transport and organisation, it full fills different special tasks depending on its location.
As long as it is located inside of the cell, vimentin forms a cave around the nucleus, protecting it from strong forces and deformation[1].
There are cell types which secrete vimentin, so it can be found attached to the cell surface or in the extracellular space.
A high vimentin concentration in the extracellular space correlates with a higher risk of microthrombi formation, what can lead to ischemic stroke or myocardial infarction[2].
Cell surface vimentin works as an attachment site for receptors and contributes in the cells uptake of virus particles[3]. Since vimentin is overexpressed in various tumor cell types it is an interesting target for cancer treatment[4].

Vimentin is a small protein, it consists only of 465 amino acids, which form one α helix. It tends to form a coiled-coil dimer, build of two helices.
At the ends of the helix you find some short loops for binding ligands or molecules.

[1] 1
[2] 2
[3] 3
[4] 4

1.2 Task 2

A mutation which increases the free energy could lead to a change in the 3-dimensional structure of the vimentin. The mutation could affect for example a double linkage bond which is transformed into a single linkage bond with more freedom of rotation.
Since vimentin mainly consists of an α helix a mutation could also disturb the uniform folding what affects the proteins functionality.
Since vimentin takes part in a cells virus uptake a structure-changing mutation of cell surface vimentin could maybe also prevent the cell from a virus invasion, but it is questionable if this won't affect the cells functionality.

1.3 Task 3

Steric hindrance describes the phenomenon how a molecule's physical structure can affect its ability to chemically react.
In Ramachandran plots you usually find secondary structures as helices and sheets in certain places. If a molecules Ramachandran plot deviates from this pattern it is a sign for a steric hindrance.
Glycine and Proline have some special side chains, allowing them a lot of rotation, which affects their Ramachandran plot.

References

[1] A. Patteson et. Al., **Vimentin protects cells against nuclear rupture and DNA damage during migration**, *Journal of Cell Biology*, 01.11.2019

[2] T. Fasipe et. Al., **Extracellular Vimentin/VWF (von Willebrand Factor) Interaction Contributes to VWF String Formation and Stroke Pathology**, *Stroke*, 11.09.2018

[3] N. Du et. Al., **Cell surface vimentin is an attachment receptor for enterovirus 71**, *Journal of Virology*, 22.04.2014

[4] A. Satelli et. Al., **Vimentin in cancer and its potential as a molecular target for cancer therapy**, *Cellular and Molecular Life Sciences*, 03.06.2011